



Weight regain after bariatric surgery

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Abstract: Obesity and weight related metabolic disorders (e.g., diabetes, hypertension, dyslipidemia, disability, non alcoholic fatty liver disease, gastroesophageal reflux, obstructive sleep apnea, some cancers) are major health problems with global concerns. Currently, non surgical methods can not provide consistent success by virtue of the fact that inadequate weight loss or maintenance. Bariatric surgery is the most effective treatment modality for morbidly obesity and related medical co-morbidities. Therefore, the number of patients undergone bariatric surgery has rapidly increased, in the last two decades in particular. However, weight regain is a phenomenon which the majority of bariatric surgery patients will encounter in the long term. Although there are abundant patients suffering from weight regain, it is one of the related topics of bariatric surgery with a relatively limited number of publications reflecting the vagueness of the entity. The factors influencing long term weight loss management after a bariatric surgical procedure can be assorted into three categories: environmental, patient related and procedure related. Environmental factors can be elucidated as threats similar to the ones that the patients' had before surgery. While patient related factors may arise from metabolic disarrangements, dietary contravention, physical inactivity or mental disorders, procedure related issues may directly originate from complications of surgically altered anatomy or patients' lack of compliance. The current review aims to clarify the definition, underlying aetiologies and management of weight regain after bariatric surgery.

Keywords: Bariatric surgery; weight regain

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Introduction

Obesity and weight related metabolic disorders are major health problems with global concerns (1). Currently, bariatric surgery seems as an unrivalled treatment modality providing success with long term durability (2). This unique feature resulted in an explosive increase in the number of patients undergone bariatric surgery (3). Nevertheless, obesity is a chronic disease and the patient's struggle is against his own body which is evolutionarily programmed to survive. This peculiar characteristic leads the body to adapt against restricted calorie intake or malabsorptive alterations of the gastrointestinal tract (4). Long term results of bariatric patient series reveal that after two years postoperatively, patients' rate of losing weight tends to decelerate (5,6). Exact definition of this state of constancy

may be tough because of the ambiguity of transition from inadequate weight loss to weight regain. The current article aims to review the definition and aetiological factors of weight regain after bariatric surgery and discuss the treatment strategies against this entity.

Definition of weight regain after bariatric surgery

According to the The International Federation for the Surgery of Obesity and Metabolic Disorders (IFSO) survey which was carried out in 2016, the annual number of bariatric cases was approximately seven hundred thousand which was less than one hundred fifty thousand in 2003 (3,7). This growing number of operations provided enormous data about bariatric procedures and patients. However, weight regain after bariatric surgery is one of the related topics

with a relatively limited number of publications. As well as there are some suggestions for the definition of weight regain, the distinction between inadequate weight loss and weight regain is unclear even in the most cited publications on this issue. One of the suggestions assuming regained weight as “significant” was established by Odom *et al.* as more than 15% of the total weight lost based on the nadir (8). Another study by Roslin *et al.* accepted that cut off rate as >10% (9). However, there are a number of studies defining the weight regain as an increase of body weight of more than 10 kg from the nadir which were reviewed by Lauti *et al.* (10). The heterogeneity of the definitions among the studies may not express great differences in reality considering individual patient management, though it may complicate scientific researches and data interpretation.

Aetiological factors

The key factors influencing long term weight loss management after a bariatric surgical procedure can be assorted into three categories: environmental, patient related and procedure related. The former two may also be associated with the patient’s being obese prior to bariatric surgery; however, the latter is a surgically created alteration and should be assessed considering the compliance of the patient with the reshaped anatomy.

Environmental factors

Obesity; as an epidemic health problem, is strongly correlated with the industrial development of food production and increased access and consumption of high calorie food supplies in large portions (11,12). Also, increased use of motor vehicles are revealed to be associated with being overweight or obese instead of more personally active transport patterns like walking or cycling (13,14). A strange aspect of the epidemic was detected as these challenging trends are not only belonged to developed regions; in contrast, rural areas have a faster increase in body mass index (BMI) rates (15). This is a surprising report since the residents of the rural areas are believed to be consuming less processed food and with more physical activity on farms, forestry and mining. The obesogenic environmental factors above are likewise threatening settings for the bariatric patient who is supposed to change his/her lifestyle and habits.

Another challenging environmental issue for the bariatric patient is family structure. In order to reach desired

outcomes, the majority of the patients require family support to alter the lifestyle and habits that impelled him/her to overeating, obesity, and co-occurring psychiatric symptoms before weight loss surgery (16,17). Single parents were reported as more unfortunate with regard to receiving family support to change eating habits and going along with family members in exercise sessions (18). Considering the data suggesting significantly increased changes in marital or relationship status among bariatric surgery patients with respect to controls, the impact of this environmental factor on weight regain is extremely hard to predict before weight loss surgery (19).

Patient related factors

In their extensive systematic review, Karmali *et al.* classified patient related factors under four subtitles apart from surgery related factors as endocrinological / metabolic disarrangements, dietary contravention, physical inactivity and mental health or psychological disorders (20). This classification involves several relevant topics in a well-rounded manner and taken as model in the current article with more recent references.

Endocrinological/metabolic disorders

Weight loss obtained by lifestyle and behavioral interventions is countervailed by hormonal regulations. However, this adaptation skill set does not emerge exactly after surgically induced weight loss. Sumithran *et al.* suggested that after a weight loss program based on dietary restriction, significant reductions in levels of leptin, peptide YY, cholecystokinin, insulin, and amylin and increases in levels of ghrelin, gastric inhibitory polypeptide, and pancreatic polypeptide were observed. These hormonal changes also significantly increased subjective appetite and hunger. The striking finding of this study is the mediators of appetite demonstrated persistence even after one year which may be responsible for weight recidivism (21). Apart from this, surgically induced gastrointestinal hormone responses showed short and long term effects on appetite in order to decrease hunger and eventually led to an increase in insulin secretion and sensitivity (22,23). Nevertheless; in patients with weight regain after bariatric surgery, these hormonal alterations were found to be reverted in experimental and clinical studies (24,25).

Dietary contravention

Bariatric surgery creates an immediate modification in

gastrointestinal system which eventually decreases caloric intake with/without malabsorption. The recent anatomy with its concomitant hormonal benefits generally brings the desired effects out in the first two years (6). The early changes in total energy intake and macronutrient composition during the first six months after surgery was found to be a predictor of long term success with 10 year follow up (26). In that study, Kanerva *et al.* also suggested that greater weight loss was achieved in patients who favored protein and carbohydrates over fat and in patients who favored protein over carbohydrates than in individuals who favored the opposite changes in macronutrient composition (26).

Grazing, a maladaptive eating behavior was defined as unplanned and repetitious eating of small amounts of food with an accompanying sense of a lack of control over this eating (27). Grazing can develop as *de novo* after bariatric surgery regardless of surgery type and it is strongly correlated with weight regain, when the weight loss reaches a plateau in particular (28,29).

Physical inactivity

Physical inactivity is suggested as one of the major risk factors for weight regain after bariatric surgery (4,20). However, the information on this subject is limited. In their systematic review, Jacobi *et al.* concluded that observational evidence of self-reported physical activity increases after bariatric surgery and that physical activity is associated with surgically induced weight loss (30). This finding was not totally in accordance with the previous report of Bond *et al.* in which they identified that patients who had lost weight through bariatric surgery were less physically active than those who had lost similar weight by non surgical treatment modalities (31). Two recent meta-analyses indicated significantly improved physical function after bariatric surgery at 12 months (32) and up to 36 months (33) both objectively recorded and self reported. Although these studies were not directly targeted towards weight regain, data about improved physical activity after surgery are generally translated to researches concerning weight regain

Mental status

Mental health conditions are common among bariatric surgery patients. Abnormal eating patterns, binge eating disorder in particular, depression, alcohol and drug addiction were reported as predictive factors of weight regain after surgery (8). Binge eating is defined as eating large amounts of food accompanied by a sense of loss of control over eating and it involves regular episodes of

excessive, uncontrolled overeating and is strongly associated with psychological stress (34). Many studies have previously disclosed disappointing results with inadequate weight loss and weight regain after surgery (20,35). Nevertheless; in their recent systematic review, Dawes *et al.* revealed that neither depression nor binge eating disorder was associated with differences in weight outcomes. In contrast, bariatric surgery was associated with postoperative decreases in the prevalence of depression and the severity of depressive symptoms (36). Another systematic review carried out by Gill *et al.* concluded that bariatric surgery has elicited long-term reductions in anxiety and depressive symptoms and they additionally recommended metabolic treatments as a viable therapeutic intervention for mood disorders (37). These recent findings may presage a new debate on this peculiar group of patients.

Factors related to surgical procedure

Weight regain can occur after all bariatric surgical procedures. However, every type of surgery may have unique patterns leading to failure. Gastric pouch enlargement and stomal dilation are the two leading entities responsible from weight regain after Roux en Y Gastric Bypass (38). Gastro-gastric fistula is a rare complication which may cause weight regain in 80 % (39). As malabsorption is another component of gastric bypass, its contribution to weight loss or the role of intestinal adaptation are matters of numerous experimental and clinical studies (40-42). Although there is no consensus on the reasoning, distalization of standard Roux en Y Gastric Bypass is carried out in some centers in case of inadequate weight loss or weight regain (43,44).

Impressive short and mid-term results gained popularity to sleeve gastrectomy as a stand alone procedure and the procedure has taken the lead from Roux en Y Gastric Bypass in terms of most performed procedure worldwide (3). Nonetheless, long term results more than ten years have shown that sleeve gastrectomy can be associated with significant weight regain and intractable gastroesophageal reflux requiring revisional surgery (45,46).

Adjustable gastric banding was one of the most common bariatric operations a decade ago, however; alongside with the rise of sleeve gastrectomy, failure in long term weight control and surgical complications with a rate of 20–30% disfavored the procedure (47). Failed gastric banding is best managed with a revisional surgery in order to achieve further and stable weight loss. Roux en Y Gastric Bypass and sleeve gastrectomy are the most preferred techniques (48,49).

The rate of revisional surgeries scaled up to 7% according to the recent survey conducted by IFSO (3). As the number of bariatric surgeries increases, revisional surgeries for further interventions will inevitably be performed both for complications and surgery related factors of weight regain.

Management of weight regain

Cumulative data acquired from bariatric surgical patients disclosed that the majority of the patients will regain at least some part of their lost weight in the long run. Which rate of weight regain is significant and what is the most appropriate time to intervene is not clear. The certainty at this point is a multidisciplinary approach for establishing a management program is far more imperative than the preoperative period. The multifactorial, sophisticated and sometimes entwined aetiologies may be encountered. The bariatric surgeon may sometimes be the first team member who the patient consults. Nevertheless, a revisional surgical procedure should be the last option due to the high complication rates with respect to primary surgeries (50). From the surgical point of view, any anatomical failure depreciating the benefits of the previous procedure which may only be corrected by a revisional surgery should be investigated. Endoscopic and/or radiological methods may help within this context.

Apart from surgical complications, a detailed assessment of the patient may discover medical causes or behavioral issues. It is mandatory to check hormonal contributions and medications which may give way to weight regain like antidepressants, anticonvulsants, antipsychotics, insulin and insulin secretagogues. Physicians must reconsider the weight potential of pharmacotherapies against therapeutic expectations (25). Dietary contraventions, physical activity levels, psychological disorders and mental health problems should be reviewed (20). It should be kept in mind that *de novo* mental issues may develop postoperatively. Behavioral and psychotherapeutic interventions may be supported by adding adjuvant medications in appropriate cases (51-53). Optimal timing of initiating pharmacotherapy is recommended when the patients have their plateau after the rapid weight loss period postoperatively (25).

Conclusions

After bariatric surgery, the lifelong struggle of the patient against his / her excess weight enters a new period. In spite of a comprehensive preoperative evaluation, education,

and preparation; the threat against weight regain will not completely be eliminated. The patient with weight regain should extensively be assessed by the multidisciplinary team with all aspects of the entity, and an individual management route should be established under the guidance of scientific evidences.

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References

1. Buchwald H, Avidor Y, Braunwald E, et al. Bariatric surgery: a systematic review and meta-analysis. *JAMA* 2004;292:1724-37.
2. Colquitt JL, Pickett K, Loveman E, et al. Surgery for weight loss in adults. *Cochrane Database Syst Rev*

- 2014;(8):CD003641.
3. Angrisani L, Santonicola A, Iovino P, et al. IFSO Worldwide Survey 2016: Primary, Endoluminal, and Revisional Procedures. *Obes Surg* 2018;28:3783-94.
 4. Kushner RF, Sorensen KW. Prevention of Weight Regain Following Bariatric Surgery. *Curr Obes Rep* 2015;4:198-206.
 5. Osland E, Yunus RM, Khan S, et al. Weight Loss Outcomes in Laparoscopic Vertical Sleeve Gastrectomy (LVSG) Versus Laparoscopic Roux-en-Y Gastric Bypass (LRYGB) Procedures: A Meta-Analysis and Systematic Review of Randomized Controlled Trials. *Surg Laparosc Endosc Percutan Tech* 2017;27:8-18.
 6. Sjöström L, Lindroos AK, Peltonen M, et al; Swedish Obese Subjects Study Scientific Group. Lifestyle, diabetes, and cardiovascular risk factors 10 years after bariatric surgery. *N Engl J Med* 2004;351:2683-93.
 7. Buchwald H, Oien DM. Metabolic/bariatric surgery worldwide 2011. *Obes Surg* 2013;23:427-36.
 8. Odom J, Zalesin KC, Washington TL, et al. Behavioral predictors of weight regain after bariatric surgery. *Obes Surg* 2010;20:349-56.
 9. Roslin M, Damani T, Oren J, et al. Abnormal glucose tolerance testing following gastric bypass demonstrates reactive hypoglycemia. *Surg Endosc* 2011;25:1926-32.
 10. Lauti M, Kularatna M, Hill AG, et al. Weight Regain Following Sleeve Gastrectomy-a Systematic Review. *Obes Surg* 2016;26:1326-34.
 11. Heymsfield SB, Wadden TA. Mechanisms, Pathophysiology, and Management of Obesity. *N Engl J Med* 2017;376:1492.
 12. Lin TK, Teymourian Y, Tursini MS. The effect of sugar and processed food imports on the prevalence of overweight and obesity in 172 countries. *Global Health* 2018;14:35.
 13. McCormack GR, Virk JS. Driving towards obesity: a systematized literature review on the association between motor vehicle travel time and distance and weight status in adults. *Prev Med* 2014;66:49-55.
 14. Wen LM, Orr N, Millett C, et al. Driving to work and overweight and obesity: findings from the 2003 New South Wales Health Survey, Australia. *Int J Obes (Lond)* 2006;30:782-6.
 15. NCD Risk Factor Collaboration (NCD-RisC). Rising rural body-mass index is the main driver of the global obesity epidemic in adults. *Nature* 2019;569:260-264.
 16. Gibbs EL, Runfola CD, Dickens CE, et al. Parenting after Weight Loss Surgery: A Conceptual Model and Two Case Reports. *Fam Process* 2020;59:1903-13.
 17. Vidot DC, Prado G, De La Cruz-Munoz N, et al. Review of family-based approaches to improve postoperative outcomes among bariatric surgery patients. *Surg Obes Relat Dis* 2015;11:451-8.
 18. Pratt KJ, Ferriby M, Noria S, et al. Perceived Child Weight Status, Family Structure and Functioning, and Support for Health Behaviors in a Sample of Bariatric Surgery Patients. *Fam Syst Health*. 2020;38:300-9.
 19. Bruze G, Holmin TE, Peltonen M, et al. Associations of Bariatric Surgery With Changes in Interpersonal Relationship Status: Results From 2 Swedish Cohort Studies. *JAMA Surg* 2018;153:654-61.
 20. Karmali S, Brar B, Shi X, et al. Weight recidivism post-bariatric surgery: a systematic review. *Obes Surg* 2013;23:1922-33.
 21. Sumithran P, Prendergast LA, Delbridge E, et al. Long-term persistence of hormonal adaptations to weight loss. *N Engl J Med* 2011;365:1597-604.
 22. Jacobsen SH, Olesen SC, Dirksen C, et al. Changes in gastrointestinal hormone responses, insulin sensitivity, and beta-cell function within 2 weeks after gastric bypass in non-diabetic subjects. *Obes Surg* 2012;22:1084-96.
 23. Saliba J, Wattacheril J, Abumrad NN. Endocrine and metabolic response to gastric bypass. *Curr Opin Clin Nutr Metab Care* 2009;12:515-21.
 24. Bohdjalian A, Langer FB, Shakeri-Leidenmühler S, et al. Sleeve gastrectomy as sole and definitive bariatric procedure: 5-year results for weight loss and ghrelin. *Obes Surg* 2010;20:535-40.
 25. Shukla AP, He D, Saunders KH, et al. Current concepts in management of weight regain following bariatric surgery. *Expert Rev Endocrinol Metab* 2018;13:67-76.
 26. Kanerva N, Larsson I, Peltonen M, et al. Changes in total energy intake and macronutrient composition after bariatric surgery predict long-term weight outcome: findings from the Swedish Obese Subjects (SOS) study. *Am J Clin Nutr* 2017;106:136-45.
 27. Lane B, Szabó M. Uncontrolled, Repetitive Eating of Small Amounts of Food or 'Grazing': Development and Evaluation of a New Measure of Atypical Eating. *Behaviour Change* 2013;30:57-73.
 28. Nicolau J, Ayala L, Rivera R, et al. Postoperative grazing as a risk factor for negative outcomes after bariatric surgery. *Eat Behav* 2015;18:147-50.
 29. Pizato N, Botelho PB, Gonçalves VSS, et al. Effect of Grazing Behavior on Weight Regain Post-Bariatric Surgery: A Systematic Review. *Nutrients*. 2017;9:1322.
 30. Jacobi D, Ciangura C, Couet C, et al. Physical activity and weight loss following bariatric surgery. *Obes Rev*

- 2011;12:366-77.
31. Bond DS, Phelan S, Leahey TM, et al. Weight-loss maintenance in successful weight losers: surgical vs non-surgical methods. *Int J Obes (Lond)* 2009;33:173-80.
 32. Herring LY, Stevinson C, Davies MJ, et al. Changes in physical activity behaviour and physical function after bariatric surgery: a systematic review and meta-analysis. *Obes Rev* 2016;17:250-61.
 33. Adil MT, Jain V, Rashid F, et al. Meta-analysis of the effect of bariatric surgery on physical function. *Br J Surg* 2018;105:1107-18.
 34. American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 5th ed. Washington, DC: American Psychiatric Association, 2013.
 35. Meany G, Conceição E, Mitchell JE. Binge eating, binge eating disorder and loss of control eating: effects on weight outcomes after bariatric surgery. *Eur Eat Disord Rev* 2014;22:87-91.
 36. Dawes AJ, Maggard-Gibbons M, Maher AR, et al. Mental Health Conditions Among Patients Seeking and Undergoing Bariatric Surgery: A Meta-analysis. *JAMA* 2016;315:150-63.
 37. Gill H, Kang S, Lee Y, et al. The long-term effect of bariatric surgery on depression and anxiety. *J Affect Disord* 2019;246:886-94.
 38. Borbély Y, Winkler C, Kröll D, et al. Pouch Reshaping for Significant Weight Regain after Roux-en-Y Gastric Bypass. *Obes Surg* 2017;27:439-44.
 39. Chahine E, Kassir R, Dirani M, et al. Surgical Management of Gastrogastric Fistula After Roux-en-Y Gastric Bypass: 10-Year Experience. *Obes Surg* 2018;28:939-44.
 40. Cavin JB, Voitellier E, Cluzeaud F, et al. Malabsorption and intestinal adaptation after one anastomosis gastric bypass compared with Roux-en-Y gastric bypass in rats. *Am J Physiol Gastrointest Liver Physiol* 2016;311:G492-500.
 41. Mahawar KK, Sharples AJ. Contribution of Malabsorption to Weight Loss After Roux-en-Y Gastric Bypass: a Systematic Review. *Obes Surg* 2017;27:2194-206.
 42. Odstrcil EA, Martinez JG, Santa Ana CA, et al. The contribution of malabsorption to the reduction in net energy absorption after long-limb Roux-en-Y gastric bypass. *Am J Clin Nutr* 2010;92:704-13.
 43. Ghiassi S, Higa K, Chang S, et al. Conversion of standard Roux-en-Y gastric bypass to distal bypass for weight loss failure and metabolic syndrome: 3-year follow-up and evolution of technique to reduce nutritional complications. *Surg Obes Relat Dis* 2018;14:554-61.
 44. Tran DD, Nwokeabia ID, Purnell S, et al. Revision of Roux-En-Y Gastric Bypass for Weight Regain: a Systematic Review of Techniques and Outcomes. *Obes Surg* 2016;26:1627-34.
 45. Felsenreich DM, Langer FB, Kefurt R, et al. Weight loss, weight regain, and conversions to Roux-en-Y gastric bypass: 10-year results of laparoscopic sleeve gastrectomy. *Surg Obes Relat Dis* 2016;12:1655-62.
 46. Yilmaz H, Ece I, Sahin M. Revisional Surgery After Failed Laparoscopic Sleeve Gastrectomy: Retrospective Analysis of Causes, Results, and Technical Considerations. *Obes Surg* 2017;27:2855-60.
 47. Elnahas A, Graybiel K, Farrokhyar F, et al. Revisional surgery after failed laparoscopic adjustable gastric banding: a systematic review. *Surg Endosc* 2013;27:740-5.
 48. Moon RC, Teixeira AF, Jawad MA. Conversion of failed laparoscopic adjustable gastric banding: sleeve gastrectomy or Roux-en-Y gastric bypass? *Surg Obes Relat Dis* 2013;9:901-7.
 49. Avsar FM, Sapmaz A, Uluer A, et al. Conversion Surgery for Failed Adjustable Gastric Banding: Outcomes with Sleeve Gastrectomy vs Roux-en-Y Gastric Bypass. *Obes Surg* 2018;28:3573-79.
 50. Fulton C, Sheppard C, Birch D, et al. A comparison of revisional and primary bariatric surgery. *Can J Surg* 2017;60:205-11.
 51. Schwartz J, Chaudhry UI, Suzo A, et al. Pharmacotherapy in Conjunction with a Diet and Exercise Program for the Treatment of Weight Recidivism or Weight Loss Plateau Post-bariatric Surgery: a Retrospective Review. *Obes Surg* 2016;26:452-8.
 52. Stanford FC, Alfaris N, Gomez G, et al. The utility of weight loss medications after bariatric surgery for weight regain or inadequate weight loss: A multi-center study. *Surg Obes Relat Dis* 2017;13:491-500.
 53. Nor Hanipah Z, Nasr EC, Bucak E, et al. Efficacy of adjuvant weight loss medication after bariatric surgery. *Surg Obes Relat Dis* 2018;14:93-8.

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